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DROPSICAL DISEASES OF PLANTS.

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RECENT progress in the study of fungi and bacteria has revealed many standing in casual relation to several plant diseases which were of a hitherto mysterious nature and which were supposed to have been due to atmospheric or solar influences. The effect has been to create a firm belief in the germ theory of plant diseases, and there is consequently a strong tendency in certain quarters to apply the germ theory to all cases of phytopathology. The first fruits of investigations leading to the determination of bacteria and fungi as the cause of certain obscure blights of plants were either rejected *in toto*, or received *cum grano salis*. Now it is the fad to attribute all phases of disturbance, short of artificial injuries or those violent injuries produced by the elements, to the agencies of micro-organisms.

It must be urged, however, that there are some purely physiological diseases of plants. But so strong just now is the leaning to the germ theory that any departure from this path must be fortified by very careful experiments and inoculations with the germs associated with the trouble in order to carry conviction not only to one's self but to others.

The writer had occasion last winter to investigate a very mysterious disease of tomatoes[1] grown in the forcing houses of Cornell University. Typical cases of the disease presented the appearance so characteristic of certain mildews. The leaves were strongly curled and the veins on the under side were swollen and whitened. Large patches of the same kind were also found to exist on the stems. Contrary to expectation, a microscopic examination did not show the presence of any fungus of ordinary dimensions in the early stages of the trouble. The young and succulent tissues of the plant were strongly turgescent and the cells in the affected areas were stretched radially to an enormous extent. These tissues ultimately collapsed and in many instances the loss of water content from these places was so great that the affected parts of the plants died. In other cases the loss of water was more gradual where the turgescence and rupture of the cells were not so profound. Then the cushions of collapsed tissue were dry, and presented a tomentose appearance, and the effect upon the adjacent tissues was to interfere with the assimilatory processes, causing the upper parts of the leaves at these spots to become yellowish in color. On the stems there resulted from the collapse of the tissues elongated, depressed and blackened areas in various stages of decomposition. These sometimes extended far beyond the first appearance of the cushions of elongated cells, showing that the trouble once started would extend to other parts of the plant.

The question now to be considered was, Are these abnormal extensions of tissue caused by the influence of some microsymbion within the plant? Healthy plants were inoculated with the material taken directly from affected tissues. No result.

Dilution cultures were then made from several different affected places and fifteen different species of bacteria were obtained, three of *Bacillus*, three of *Micrococcus*, and nine of *Bacterium*. Cultures of these were made in liquid media and healthy plants were inoculated, but there was no result.

These negative results from inoculation and also the fact that when using the necessary precautions to prevent the entrance of gems from the outside, no growth occurred when culture media were inoculated with material from the interior of freshly affected areas of the plant, led to the conclusion that the trouble was due to some physiological disturbance of the plant, probably that root pressure, as it is termed, was greater than transpiration.

The conditions of the green house were such as to produce active and almost constant root absorption, while they were very unfavorable for transpiration, since there was very little disturbance of the air, the part of the house where the tomatoes were grown was poorly lighted, and the winter days were very short as compared with the nights. In the open during the summer currents of air remove quickly the water vapor given off during transpiration. This, with the longer days, favors rapid transpiration. The heating of the forcing house is also such as to make but little difference between the temperature of the soil and that of the air, and also the temperature of the soil is such as to make the roots active almost continually, while in the open there is a much greater difference between the temperature of the soil and air, in such ratio in the summer that root pressure and transpiration are more evenly balanced.

Cuttings of healthy plants were then connected with the hydrant by means of rubber tubing, the pressure of water turned on being twenty to thirty pounds. The pressure of water was so great that in a very few minutes drops of water stood out at the ends of the veins on the margins of the leaves. In a few days, since this abnormal pressure was in excess of transpiration, cushions of turgescent tissue exactly like those developed under the conditions of the forcing huse, were produced.

Another proof that the cause of the trouble was excessive turgescence is furnished by the relation of growth to the trouble. Where active growth was taking place in the cells the radial elongation did not take place. The increase in number of cells and the natural increase of the size of the cells were sufficient to accommodate the amount of water distributed to those parts of the plant. So that when there was no immediate interference with the growth of the terminal portions of the plants there were no cushions developed on the ends of the stem or branches for a distance of four to six inches. But just so soon as the growth by increase of cells ceased the cushions of turgescent tissue appeared. Also in the case of some plants on one bench, when the tops reached the glass roofing and the confined condition interfered with growth, the trouble appeared even to the extreme tips of the stem and branches. It is also to be noted that the short days and poor lighting of the house gave little opportunity for the metabolic processes in the manufacture of building material for the formation of strong cell walls.

Recently a similar trouble has fallen to my lot to investigate, which occurred on apple trees. Numerous blisters appeared on the trunk and branches of young and vigorous orchard trees. These blisters were caused by the radial elongatian of the phellogen layer of cells just beneath the periderm. The tissues ultimately collapsed, and were then subjected to the attacks of putrefactive bacteria and fungi. Inquiry of the owner developed a fact which was already inferred, that the plants were under such conditions that growth was very rapid, and then during the winter and spring were subjected to

[1] Oedema of the tomato, Bull. 53, C. U. Exp. Sta., May, 1893.

a very severe pruning. When growth began in the spring there were no leaves to produce active transpiration, and but few growing points to accommodate the excess of water which the large root system was continually pumping up. The excess of water in the phellogen layer was drawn into the interior of the cell protoplasm by the vegetable acids, and since it could not filter out readily, nor be removed sufficiently fast by transpiration, the cells were abnormally stretched and at last collapsed.

Similar troubles have been recorded as appearing on other plants, as potatoes,[1] grapes,[2] rose and plum seedlings, gooseberries, beans[4] and pears[5]; and recently Halsted has recorded it on pelargoniums.[6]

THE SPEECH OF ANIMALS.

BY HOWARD N. LYON, M. D., CHICAGO.

THAT animals have a means of communication among themselves through certain vocal sounds is a well established fact; that these vocal sounds are of sufficient range to express other than mere physical ideas, and thus to assume the importance of a language, is probable, although as yet unproven. It is towards the final settlement of this question that I wish to add my mite, and, while there is much that might be said, in the present instance I will confine my observations to a field but little explored—the attempts of animals to communicate with man.

For the last three years I have had a tame fox squirrel of which I have made a great pet. Polly has occupied a cage in the laboratory where she has been, for the most part, shut off from the sights and sounds of the outside world. Although at times the laboratory has had other tenants in the shape of squirrels, rabbits and guinea-pigs, she has formed no particular attachment for any of them, but when I am about she is usually close to me, either on my shoulder or following me about like a dog.

Unconsciously at first and later with a definite purpose I have talked to her much as one would talk to a young child. About a year ago she began to reply to my conversation. At first it was only in response to my questions as to food, etc., but later her *"talk"* has assumed larger proportions until now she will, of her own accord, assume the initiative.

Her vocabulary appears to be quite extensive, and while, for the most part, it pertains to matters of food and personal comfort, there are times when it seems as though she were trying to tell me of other things.

When I first go out where she is in the morning she immediately asks for food, and until that want is supplied she keeps up a constant muttering. Later when her hunger is appeased she will ask to be let out of the cage. Often when playing about the room she will climb onto my shoulder and *"talk"* to me for awhile in a low tone and then scamper off. Unless she is sleepy she will always reply to any remark made to her.

Her speech is not the chattering ordinarily observed in squirrels, but a low gutteral tone that reminds one both of the low notes of a frog and the cluck of a chicken. Some of the notes I have been able to repeat, and invariably she becomes alert and replies to them. Unfortunately, the effort to reproduce her tones produces an uncomfortable effect on my throat, and I have been obliged to desist from further experiments in that direction. The sounds that she makes are quick and in low tone, so the attempt to isolate words is very difficult, yet there is as much range of inflection as in German.

Another reason why I believe she is endeavoring to communicate with me is that she has used the same sounds towards other squirrels confined in the same cage, and that, while she will answer any one who addresses her, she voluntarily will only talk at length to me. That she understands what is said to her is beyond question, and, furthermore, she will distinguish between a remark made to her and one made to some one else.

I have had many pets that would answer in monosyllables to a question asked them or indicate by actions their desires, but this is the first instance that has come under my observation in which an animal has attempted more that that.

When Polly first commenced *"talking,"* I regarded it merely as idle chattering, but further observation shows that it is not such, and that the sounds she makes have a definite meaning. Moreover, the sounds she makes in *"talking"* are not the shrill notes of anger or alarm, but low, clear sounds that are unmistakably articulate.

In my fondness for my pet, have I overestimated the value of the sounds she makes, or am I right in assigning to them the characters of speech? Why should an animal not attempt to communicate with man? The higher animals are possessed of a well-formed larynx and vocal chords. Why, then, should we deny or ever question the possibility of articulate speech? And, if they can converse among themselves, why may they not attempt to communicate with man?

Anyone who has owned a well-bred dog can relate numerous instances in which his dog has clearly understood what was said to it, and the readiness with which a dog learns a new command shows an intelligence of a high order. Although a dog's vocabulary is of limited range, it has certain definite sounds that possess an unmistakable meaning. There is the short, sharp bark that expresses a want, the low, nervous bark that means discomfort, the sharp, quick bark of joy, the low whine of distress, the growl of distrust, the deep growl of anger, the loud bark of warning and the whimper of fright. When to these is added the various movements of the body, cowering in fear, crouching in anger, the stiff bracing of the body in defence, leaping in joy, and many special actions, as licking the hand of the master or pulling at his clothes, we find that a dog can express his likes and dislikes, his wants and his feeling as clearly as though he were human. Anyone who, in a time of sorrow or depression, has had his dog come to him and lay its head in his lap and has looked down into those great brown eyes so full of sympathy and love, can never doubt that the dog understood all, and in its own way was trying to comfort.

A friend's cat has an unmistakable sound for yes and no. The former is a low meyouw, while the latter is a short, sharp m'yoww. If Tom wants to go out that fact is made manifest by a quick meyouw'. If, perchance, anyone should be in the chair which Tom regards as his especial property, no regard for propriety restrains him from indicating that fact and unceremoniously ordering the instructor out. His me'youw' on such an occasion can not be mistaken. Instances of this sort are not uncommon and ordinarily fail to attract attention, but is there not here a field that will well repay a careful investigation?

Until my pet squirrel commenced her performances I regarded these things as a matter of course, but her chattering has raised with me the question, Is it not possible that our animal friends are endeavoring in their own way to talk to us as we talk to them?

[1] Ward, on some relations between host and parasite. Proceedings Royal Society. XLVII, 1890, p. 393-443.
[2] Gardener's Chronicle, 1878, I. 802, and 1880, I. 303.
[4] Sorauer, Wassersucht bei Ribes aureum, Freihoff's Deutsche Gartnerzeitung, Aug. 1880.
Pflanzenkrankheiten, Zweite Auflage, I. 235-238. Goeschke, Die Wassersucht der Ribes, Monatsschrift d. Verein z. Beford d. Gartenbaues in den kgl. Staaten, October heft 1880, 451.
[5] Quad us, Wassersucht bei Birnen, Jahresb. d. Schles. Centralverein's fur Gartner und Gartenfreunde zu Breslau, 1881.
[6] Bulletin Torrey Bot. Club, XX., 1893, 391.

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INTERPRETATION OF MAYA HIEROGLYPHS BY THEIR PHONETIC ELEMENTS.—I.

BY HILBORNE T. CRESSON, A. M., M. D.

THE intent of this article is to demonstrate, as briefly as possible, the method pursued in my endeavor to analyze the Maya hieratic and demotic script by the phonetic elements of which it is composed. So far as the work has progressed the indications are that the Maya graphic system, like that of other early peoples, is based upon a primitive ideographism, most of its elements being derived from motives suggested by organic or inorganic nature and objects invented by man for his necessities. The symbols were gradually given phonetic significance, and had advanced to that stage which Dr. D. G. Brinton has designated the *ikonomatic*. The Maya script, like the ancient Mexican, is largely of this character. There are indications that the Maya script had begun to enter a stage even more advanced than that of the ikonomatic. At times sounds even so meaningless as that of a single letter are to be remarked; this is very rare. It is not my intent to advocate that they had arrived at a stage where each sound was indicated by a certain element or sign. They had, however, reached a point in their progression toward an alphabetic method where we find ideographic suggestions, phonetic characters and phonetic additions, intermingled. Particular attention is called to the assertion "begun to enter a more advanced stage" for the ikonomatic method prevailing, in the majority of cases, it is evident that the advance into another stage was but in process of transition.

The consonant sounds are indicated by the characters, yet syllabic characters frequently appear. Vowel fluctuation is one of the most important factors in Maya script, and the various combinations produced by the Maya scribes require careful and especial study. The sign v-s is proposed for this peculiarity where it occurs. For instance, Fig. 122 is a genuine syllabic character, the guttural consonant k, whose variants play an important part in Maya script. Its phonetic values seem to be kan, ka v-s, an v-s, k. Where ka v-s is indicated it is meant that this element and its variants may have any of the phonetic values, ka, ke, ki, ko; ak, ek, ik, ok, and that an v-s may = an, en, in, on; na, ne, ni, no. It is to be remarked that this method of using a syllable and portions of a syllable is quite common in Maya script. The element ban, Fig. 135, has the phonetic value of ban, ba v-s, an v-s. The syllable cab is represented by Fig. 125; it has the phonetic value of cab, ca v-s, ba v-s, and also the additional phonetic value of Ma v-s. The character of the Maya language explains these peculiarities, most of its roots being monosyllables or dissyllables, and, as in all languages, largely monosyllabic, there are many significations attached to a single word. Cab, for instance, has twelve or more different meanings. The face glyphs and drawings that accompany demotic script, and the sculptured representations that appear with hieratic script, it is my opinion, are composites of phonetic elements and ideographic suggestion, and it is an important question whether the peculiar ornamentations or decorations of the ancient Mayan structures of southern Mexico are not closely allied to these composites. This has already been suggested by me in other publications.

The plates accompanying this article, from Fig. 1 to Fig. 192, give a series of elements to which certain phonetic values have been assigned, these having been frequently repeated in new combinations with probable results, corresponding in some cases with the interpretations of De Rosny, De Charency and Thomas. They are now offered for consideration to Maya students, and as a basis for future progress in the work, subject to further alteration and change. An interesting fact is their resemblance to many of the phonetic elements of the day signs of the Chilan Balam of Kaua, which is a demotic form of the script that can readily be traced to that of the older codices. Most of the phonetic elements obtained by me and given in this article are derived from analyses of the day signs of Landa and a few of the month signs; from analyses of the hieratic script of Palenque, the Yucatec stone of the Leyden Museum and a vase in the Peabody Museum, Harvard University, found at Kabahr by Mr. Edward Thompson, United States Consul to Merida, Yucatan. The inscription on this vase is, in the opinion of Dr. D. G. Brinton and myself, a beautiful example of the demotic form of hieratic script. Variants of some of the phonetic elements on this vase may be seen in Figs. 1, 3, 4, 8, 10, 19, 22, 27, 43, 84, 85, 92, 122. Especial attention is called to the fact that many variants exist of the phonetic elements given in my list, and to use them one must habituate himself to these variations. Vowel fluctuation is the only method, in my opinion, that can explain some of the combinations used by the scribes in forming their glyphs. Especially is this puzzling in more demotic forms of script, yet I venture to say that there are but few of the day signs of the Chilan Balam of Kaua that cannot be analyzed by my method, and their evolution from those of Landa demonstrated. Space will not permit further discussion of this interesting subject.

It is to be remarked before beginning our list of values assigned phonetic elements that the consonant x or sh is interchangeable with that of ch.

Figs. 1, 2, 3, 4 = Ha v-s, a, kan v-s, ka v-s, an v-s.
Figs. 7, 8, 9, 10 = Cab, ca v-s, ba v-s, ma v-s, m.
Figs. 11, 154, a, b = Ka v-s, za v-s, composed of Fig. 6 and Fig. 1; see Fig. 154, a, b.
Figs. 12 to 22 = Man, ma v-s, an v-s.
Fig. 23 to 26 = Na v-s. Fig. 26, variant of element in day signs, Chuen and Akbal. The day sign Akbal is probably akanbal = bal, "object" or "thing," acaan = "set up"; is allied to Fig. 162, the chak glyph, composed of ideo-phonetic elements suggesting akaan-tun or "stones set up," symbols of

the chaks or bacabs and of Haa = water descending to fertilize the earth. To these perpendicular symbols we have assigned the phonetic values Ha v-s, a, kan, an v-s derived from Haa = water and akaan = "set up." They are among the most primitive elements in the Maya graphic system, and their values have been repeated so often in new combinations that there is little doubt in my mind of their truth. Combining Figs. 1, 79, 9 and 6, an ideograph of sky, water and earth is obtained, Fig. 193. Take Figs. 2 and 4 (adding black color = ik or eek) and the symbol of the four bacabs or chaks supporting the sky is apparent. Combine Figs 1 and 6 and the chak, bacab, or "wind symbol," Fig. 154 is obtained—the so-called "cross." There is more method than accident in these combinations, a strong proof that the elements composing the glyphs are phonetic, as they stand for the sound of the name of the thing represented = ikonomatic.

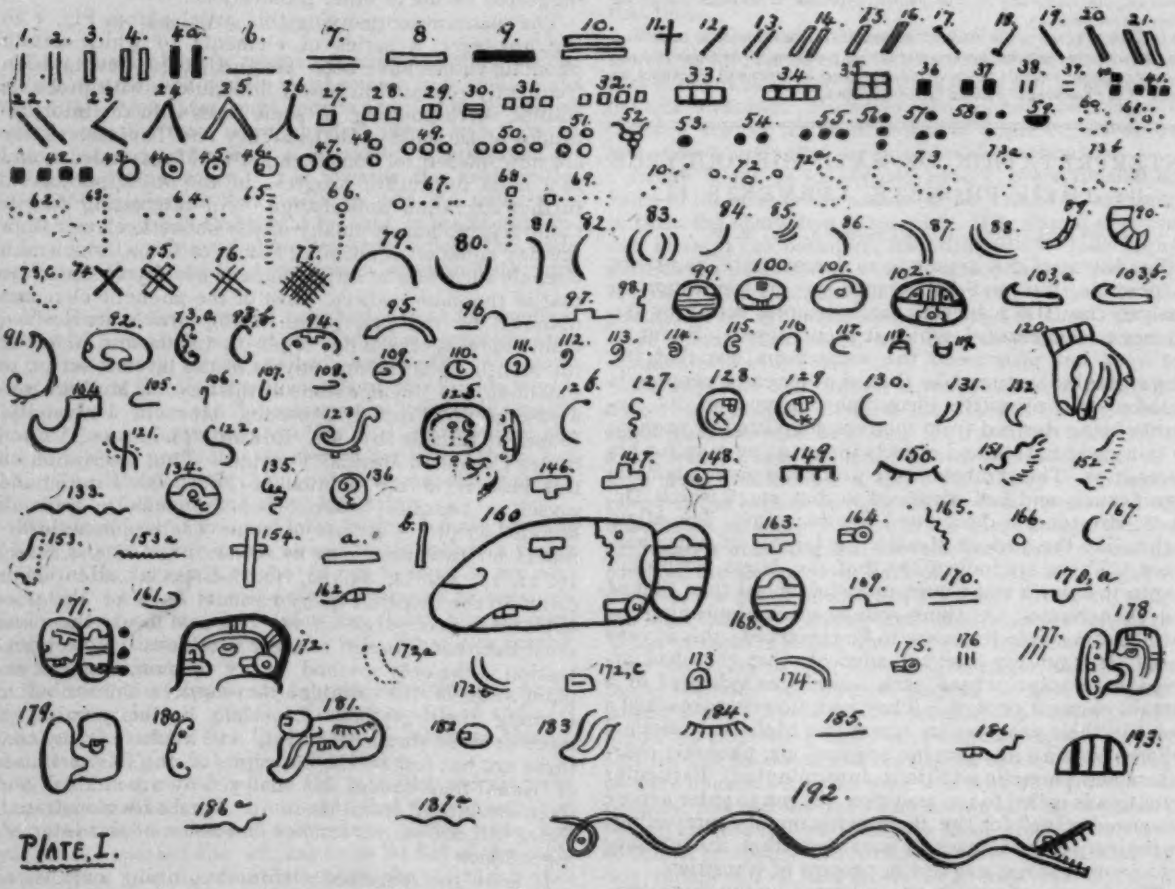


PLATE I.

Figs. 27, 28, 29, 30 = Ka v-s, a. Especially allied to á sounds; probably a vowel element. Is used as a phonetic addition in certain glyphs, e. g., Fig. 100, day sign kan.

Figs. 31, 33 = Xo v-s or sho v-s, cho v-s.

Figs. 32, 34, 35, 35^a kan v-s, ka v-s, an v-s.

Fig. 36 = hun, un.

Figs. 37, 38, 39, 40 = ki v-s (often used as a phonetic addition).

Fig. 41 = Xi v-s.

Fig. 42 = X.

Figs. 43, 45 = i, o, u (vowel?)

Fig. 44 = ich, ik v-s, i.

Fig. 46 = hun, un, ho v-s

Figs. 47, 48 = Ca v-s, ich, ik.

Fig. 49 = Xo v-s, sho, cho v-s.

Fig. 53 = hun, un, i.

Fig. 54 = Ca v-s, ich, ik.

Figs. 55 to 59 = Xo v-s, sho v-s, cho v-s.

Figs. 60, 61, 62 = Xo v-s, sho v-s, cho v-s, Ho v-s (dotted aspirate circle).

Figs. 63 to 69 = Xa v-s, sha v-s, cha v-s, Ha v-s (aspirate line with phonetic addition). Figs. 27 and 43.

Fig. 70 = Xan, Xa v-s, shan, chan, cha v-s, Ha v-s.

Fig. 72 = Xo v-s, sho v-s, zo v-s, cho v-s, Ho v-s.

Figs. 72^a, 73 = Xan, Xa v-s, an v-s, chan v-s, Ha v-s, cha v-s, Ha v-s.

Figs. 73^a, 73^c = Xan, Xa v-s, an, cha v-s, Ha v-s.

Fig. 73^b = Xo v-s, cho v-s, Ho v-s.

Figs. 74 to 78 = Xan, shan, chan, zhan, Xa v-s, cha v-s, an v-s, Ha v-s.

Figs. 79 to 80 = Kan, chan, ka v-s, cha v-s, an v-s. (Motive derived from the life line of the serpent kan; see Fig. 192).

Figs. 81 to 86 = Man, Ma v-s, an v-s.

Figs. 87 to 88 = Cha v-s, Xa v-s, sha v-s.

Figs. 89 to 91 = Cha v-s, Xa v-s, sha v-s. (From Chilan Balam of Kaua).

Fig. 92 = Cha v-s (ch'i glyph from ch'i to bite, pinch, cling to; phonetic addition in this case indicates its value to = i; see Fig. 43).

Fig. 93 = Cha v-s.

Figs. 93ª, 94 = Ah, u (Generally used as a prefix; its phonetic elements are a variant of Figs. 92 and 93ª, Fig. 48 and Fig 163, expressing cha v-s, Ha v-s, from which ah is obtained. Its u value is suggested by chu from cha v-s).

Figs. 95 to 98 = Cha v-s, chan, an v-s, Ha v-s. Fig. 99 shows this element combined in a circle, see Fig. 171, glyph of kukulkan; see also day signs Muluc, kan, cib, akbal and their variants. See Figs. 100, 101. In Fig. 102 it appears in the well-known chak glyph of the Peresianus, whose phonetic elements express the words chak-ik = "God of Wind." See also this element as it appears in Troano 22ª, an upper row of glyphs.

Figs. 103ª, 103ᵇ = Cha v-s, chan. Variant of Figs. 92, 105, 108; frequently appears with face glyph of the so-called "Long-Nosed God," or kukulkan.

Fig. 104 = Cha v-s, chan, an v-s; derived from Figs. 92 and 8; see sculptured representation of the "Long-Nosed God," left wing of Palace at Chi-chen-itza; see also sculptures of Labna and Kabah, etc.

Figs. 105 to 111 = Chan, cha v-s, an v-s, Ha v-s; variants of 92, 93, 103.

Figs. 112, 113 = Ca v-s, combined with the twisted line, as in the day sign cib. See Figs. 134, 135, 136, 137; it expresses ciban from which cib is derived. See also day signs caban and the cabil or honey glyph, Fig. 125; see also variants of this glyph in Codices.

Figs. 114 to 119 = Cha v-s, Ha v-s.

Fig. 120 = Cha v-s. The "pinching hand," with crustacean-like thumb, suggesting by its action ch'i = "to bite, pinch"; see Plate 24, Troano.

Fig. 121 = Xan, chan, shan, cha v-s (variants derived from the serpent motive, Fig. 192).

Fig. 122 = Kan, chan, ka v-s, an v-s, n (variant of Fig. 192; see Landa's n, representing the final letter of the word kan. The letters of Landa's alphabet, viz: a, b, c, e, k, n, ka, ku, x, are all derived from kan elements, and are attempts of a Maya scribe, or Landa himself (?), to approximate to the sounds of the Castilian alphabet such as ah, bay, thay, é or a, ain-nay, aikeys; k does not exist in the Spanish alphabet, but is represented in Maya script, not only by variants of the serpent line, Fig. 192, but also by a face glyph, which is a composite of phonetic elements having the values of kan, ka v-s, cha v-s; see Figs. 172 to 177. It is not only ikonomatic recalling ku = "a god," but is used with the phonetic value of kan, ka v-s. The addition of the hissing aspirate, half circle, Fig. 172ª, gives it the phonetic value of x or sh, also of ch.

Fig. 123 = Ca v-s, cha v-s; is a variant of Figs. 192 and 122. See face glyph of kukulkan (so-called Long-Nosed God) in Codices and hieratic script.

Figs. 125 to 127 = Glyph expressing cabil = "honey."

Fig. 126 = "L curve."

Fig. 123 = Kab or cab, honey glyph (see Peresianus, Plate 23) composite of Fig. 127 = ca and the twisted line ban, Fig. 135, 137; see variants of the day signs cib and caban in codices. The dotted aspirate line also appears as one of its components, Figs. 63 and 66 = cha. From the element, Fig. 113 and Fig. 127, we obtain the word caban, suggesting cab, and this prefixed to the il curve, Fig. 126, gives cabil = "honey." The glyphs underneath this compound glyph are variants of Figs. 118 and 119 and = cha. The element placed between is a variant of Fig. 63, with the vowel element = a above; one of its phonetic values is also cha. The glyph to the right is the prefix Fig. 93 = in this case, u. We, therefore, obtain the suggestion u-cabil = "honey" or "sweets." Cha. is repeated several times. In certain glyphs we frequently find repetitions of certain sounds as if the scribe desired to prevent any mistake in the meaning of the glyph, or else considered their audition as phonetic elements improved the appearance of the glyph. It cannot be denied that the arrangement of the phonetic elements composing these glyphs has a high degree of artistic excellence. The l curve, Fig. 126, in the glyph just analyzed, is combined with Fig. 53, one of whose values is i. We see given in glyphs Figs. 128 and 129 (refer to Plate 22ª Troano) appearing in connection with the representation of an armadillo caught beneath a trap. On the top of the wooden bars composing the trap are three glyphs shown in my Fig 136. It has for component parts three small squares, variants of Fig. 35ª, one of whose values = cha. Joined to it is the l curve, see Figs. 126 and 130, giving chal. The element Fig. 74 is represented = cha v-s or xa v-s, cha v-s, from which we obtain by vowel fluctuation che or xe; suffixing this to chal or xal we obtain chalche. The glyphs, Figs. 128 and 129, either represent pieces of calcareous rock, chalche, placed upon the bars of the trap, or else the word is used to recall the word che = "wood." The glyph itself may represent round bars of wood calche that have been sawed across and laid on top of the trap or cage drawn by the scribe. If the interpretation "wooden bar" be accepted it coincides with and proves the interpretation of Dr. Thomas to be correct. The method herein set forth, in fact, coincides in its results with many of the interpretations made by my colleague of the Bureau of Ethnology, Dr. Thomas, and one method of procedure is, in fact, but a check upon the other.

Figs. 131 and 132 = Co or ku v-s, chu v-s (see day sign chuen). In the day sign akbal these same elements appear placed in a perpendicular position. Its value, instead of being ku or chu, as in chuen, is ak or ach, derived

from ku v-s or chu v-s, thus: ka, ke, ki, ko; ak, ek, ik, ok. It is an excellent example of how the same elements appear in new combinations with different phonetic values, these being influenced by vowel fluctuation.

Figs. 146, 147 = Uch v-s.
Fig. 148 = Ka v-s.
Figs. 149, 150 = Kan, ka v-s, an v-s.
Fig. 151 = Yox, iax, yosh, iash, sh, h, xa v-s. The value of this element will be demonstrated in Part II. of this article.

The phonetic values assigned a series of elements having been given, let me proceed to apply some of them to certain glyphs beginning with Fig. 160. This glyph, and variants of it, is frequently found in the codices in connection with a figure which has been designated, for the sake of convenience, "The Long-Nosed God," whom there is good reason to think is kukulkan. A glance at this glyph shows it to be a representation of an elongated reptile-like head, an ideographic suggestion of the serpent god. In the nose we have the elements, Fig. 105 = cha, curved around into a loop-like end, Fig. 161. The mouth line must not be confounded with the parallel earth line. At times small tooth-like squares (Figs. 28, 29, 30) are attached to it—similar to those shown in our Figs. 31 and 34. They seem like phonetic additions placed to indicate the especial phonetic value of the element to which they are attached. In this case there are two squares attached = ca. As chi = "mout" we accept the suggestion as cha or kha (c = k in Maya). It will be observed that the end of the mouth line is somewhat curved upward (see Fig. 162). It might at first be thought the result of accident but an examination of other glyphs (Figs. 171 and 181) shows that this is not the case. Figs. 181, 186, 187, show the mouth element, Fig. 185, connected with a curved line, a motive derived from the life line of the serpent kan, Fig. 192. This line, Fig. 187 a and Fig. 133 has the phonetic value of kan, ka v-s, an v-s. Chan is the evident phonetic value represented by our element, Fig. 162. We shall see it repeated with like value in other face glyphs yet to be analyzed. Fig. 163 we have assigned the phonetic value of uch v-s, and by vowel fluctuation we obtain cha (see values assigned Figs. 146, 147). The element Fig. 167 = cha or kha or ka. The element shown in Fig. 165 is composed of the perpendicular line, Fig. 1 = ka, and the twisted line, Fig. 135 and Fig. 153[a] = ban v-s, ba v-s an, b; its value an is here used, which, placed after ka, = kan or kaan. Fig. 165 by reference to the list at Fig. 45 = o or u. Fig. 166 = cha; it is a variant of the ch'i glyph, Figs. 92 and 93, 114, 115, 116, 117. The Fig. 168 has a like value, as our element Fig. 99 = chan or kan. The components, Figs. 169, 170, 170[a], by reference to Figs. 7, 8, will be seen to have the value of ka or ca. All of the elements composing this glyph are kan elements recalling "chu-cha-chan" or kukakan.

Fig. 171 from the Codex Cortesianus is composed of a similar series of kan elements, the three perpendicular black dots to the right of it repeating xo (= three) or chu; so is Fig. 181 with its components, Figs. 182, 183, 184, 185, 187; all kan elements arranged into a face glyph.

In Fig. 172 we have another important face glyph which is a composite of kan elements. Curving upward around the mouth (= ch'i) Fig. 172[c] is the an curve, Fig. 84, recalling chan. The element in the nose position, Fig. 173, = cha; see Figs. 109, 110, 111. The curved line, Fig. 174, = cha. It is a variant of Figs. 87 and 88 of my list and appears in many different combinations with this value. Some of them will be demonstrated in Part II. of this article. Fig. 175 has already been used, as cha v-s in Fig. 160. The same phonetic value is represented here. Fig. 176 is a series of Figs. 1 and 2 = ka, and Fig. 177 are variants of Figs. 12 and 13, 14 = an, giving kan. All the elements in this face glyph are kan elements. Where the dotted line Fig. 172[a] is prefixed to the glyph it gives the hissing sound of x, sh, or ch and the glyph becomes xan or chan.

Fig. 178 has as one of its components a variant of the kan glyph, Fig. 172. The face or head is represented in the act of sucking the nipple of a breast. Hoobnelil, Fig. 179. Inside of the outline of the breast, Fig. 179, is the ah prefix, Fig. 180. We have thus recalled by the prefix ah, by the representation of a breast, hoobnil, and by the glyph, a variant of Fig. 172, = kan, the name of the bacab or chak, who represents the cardinal point south, = ah-Hoobnil-kan. The glyph is taken from the series, Codex Troano, Plate 25*, and proves the assignment made by De Rosny to be correct. It is an excellent example of the ikonomatic method of writing used by the ancient Mayas, a similar method being used by the ancient Mexicans, and to use the words of Dr. D. G. Brinton in a letter received by me from that distinguished Americanist, "hence it probably obtained in the Maya."

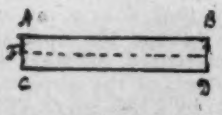
[To be continued.]

DOUBLE SURFACES.

BY HENRY I. COAN, CAMBRIDGE, MASS.

THE double surface was discovered by Moebius, probably about 1858, and he called attention to some of the peculiarities of the surface as he constructed it, and which has been called after his name, "Blatt des Móebius." Since his time this surface has been studied to some extent, especially by German mathematicians, and many forms of the double surface have been found beside that of Moebius. The most recent work on the subject is by F. Dingledey—"Topologische Studien über die aus ringförmig geschlossenen Bändern durch gewisse Schnitte erzeugbaren Gebilde" (Leipzig, 1890). In this work Dingledey gives a pretty complete bibliography of the subject. The existence of these surfaces is, however, little known, and it may be of interest to describe the simplest form, aside from any mathematical interest which may be attached to the subject.

The simplest form of a double surface may be constructed as follows: Take a strip of paper, whose edges we will denote as in the figure by AB and CD, and bend it imto a ring, at the same time revolving one end through 180°, so that B will fall on C and D fall on A. Now glue



the two ends together. We shall then obtain a band, which has the distinctive properties that it is bounded by only one edge and has only one surface. In other words, we can pass from any point in the surface of the paper to the corresponding point on the other side of the paper without crossing the edge. This is the simplest form of a double surface.

If, now, we cut our band along the line marked EF in the figure, it will drop apart into a new band of twice the length of the former band, but the new band will no longer be a double surface. The reason for this is obvious.

In the original band we could pass continuously along the edge from B to A (= D) to C (= B) back to our starting point. Now, in cutting along the line EF we nowhere cross this continuous edge, so that it will remain an edge of the new surface, while the cut will form a second edge of the new surface. We have thus removed one of the distinctive characteristics of the double surface, by having a surface bounded by two lines. Furthermore, it will be impossible to pass in the new band from a point on one side of the paper to the corresponding point on the opposite side without crossing the edge. The reason for this will be more obvious in the following:

In forming the double service we revolved one end of the strip of paper through an angle of 180°, about, say, the point E, or, better, the line EF. It is clear now that if, instead of revolving it through an angle of 180°, we had revolved it through an angle of 2x180°, the point B would have fallen on A and D on C, so that we should have two continuous edges to our surface, and it will no longer be a double surface. We can then say, in general, that if we revolve the end of the strip of paper through an odd multiple of 180°, before fastening the two ends together, we shall always obtain a double surface, whereas if we revolve through an even multiple of 180° we have an ordinary surface. By this means we can distinguish double surfaces from ordinary surfaces.

We will now return to the surface obtained by cutting the double surface along the line EF and see why it must be an ordinary surface. The double surface originally had a twist of 180°. Suppose, now, we have cut it as indicated, but do not let the ends drop apart; then each part on either side of the cut will have a twist of 180°, or, together, 2x180°. If we let the surface fall apart we double the twists again, and our new surface has a twist of 4x180°, and it is therefore an ordinary surface. That this is so may be easily verified by cutting the band across and revolving one end until the strip has no twists, when it will be found that it has to be revolved through 4x180°.

If we cut a double surface obtained by rotating through 3x180° along the line EF, we shall find that we have introduced a knot in our new surface, which in other respects will, however, be an ordinary surface. These knots will be multiplied, as we proceed, to surfaces containing a higher number of twists.

It is easy to see that if we cut an ordinary surface, obtained by revolving the end of our paper through 2x180°, along the line EF, we shall obtain two ordinary surfaces, which are, however, interlinked. The same holds for surfaces with a higher number of twists, where, however, the interlinking becomes more complicated.

Another interesting set of results may be obtained by cutting the surfaces along a line parallel to the edge at a distance from the edge less than one-half the width of the strip of paper. The results will be different in the case of double and ordinary surfaces.

BOTANICAL NOTES FROM WESTERN PENNSYLVANIA.

BY HUBERT LYMAN CLARK, PITTSBURGH, PA.

On looking over my field notes for the spring and summer of 1893, I find there are a few facts the preservation of which may be worth while, in the hope that before long some competent botanist will prepare an annotated list of the plants of western Pennsylvania. There is not at present, so far as I know, any such list, and its appearance would be welcomed by all our local botanists. Whenever the work is undertaken it will be desirable to have as much material in available form as possible, and so I have presumed to publish my important notes in *Science*, hoping they will also prove of interest to botanists elsewhere.

On analyzing specimens of *Delphinium* from the country around Pittsburgh last spring, I was struck with the rich coloring of the flowers. There was not the least doubt about the plant being *D. tricome*, but, to my surprise, Gray's "Manual" says the flowers of *D. tricome* are "bright-blue, sometimes white," while every specimen which I examined had "royal purple" flowers. Thinking that the trouble might be in my sense of color, I looked through the "Manual" for other "bright-blue" flowers. I found *Aster undulatus*, *Chicorium intybus* and *Campanula rotundifolia* so given, and I should certainly call them so, but the *Delphinium* of this vicinity has flowers of the same color as *Liatris scariosa*, which Gray calls "rose-purple," or perhaps nearer to *Aster novæ-angliæ*, which is given as "violet-purple." Never having seen *Delphinium* growing elsewhere, I am curious to know if in other parts of its range it really does bear flowers similar in color to *Chicorium* or *Campanula*, or whether it is not a slip of the pen in the "Manual" to describe them as "bright-blue." In the same work (which is perfectly invaluable to an amateur botanist in the east) *Silene nivea* is recorded as "rare," and it is with great pleasure, therefore, that I can report it as abundant in several places around Pittsburgh. Indeed, I am inclined to think it is the most common representative of its genus in this neighborhood.

None of the botanists whom I have consulted record *Trifolium stoloniferum* east of Ohio, and it is therefore very pleasant to be able to record it from Pittsburgh. On the 8th of last June I found it growing in an open space in some woods about six miles east of the city. While it is of course possible that it has been introduced, it was growing so far from any house or highway as to certainly appear indigenous. There is no specimen of this clover in the herbarium of the Western Pennsylvania Botanical Society, and I am inclined to think this is the first record for the State.

Gnaphalium purpureum is reported in the "Manual" to occur in "sandy or gravelly soil, coast of Maine to Virginia and southward." It is not very clear from this how far inland we may expect to find it, but certainly the implication is that it is a seashore plant It may be worth while, therefore, to record that it is not very rare around Pittsburgh, three hundred and fifty miles from the coast! I found it growing in Arlington, twelve miles south of the city, in June last, and there are a number of specimens in the herbarium of the botanical society to which reference has been made. These specimens are from widely-scattered points in the county, and would seem to indicate regular and not uncommon occurrence. One of the most abundant weeds in many parts of Pittsburgh is a species of *Galinsoga*, differing from *G. parviflora* in the scales of the pappus and being very hairy instead of smoothish. Dr. Robinson, of the Gray Herbarium, Cambridge, to whom I am indebted for many favors, kindly identified the specimens sent to him as "a possible variety of *G. hispida*," or at least so it may be considered provisionally. Similar specimens are reported from Milwaukee and Providence. Whether *G. parviflora* occurs in Pittsburgh I cannot say, but I have not yet found any specimens agreeing with the description in the "Manual." Another plant which Dr. Robinson identified for me is also an introduced species reported in the "Manual" as "rather rare; in cultivated grounds." I refer to *Veronica arvensis*, two specimens of which I sent to Cambridge, supposing them to represent different species, they were so unlike. One of them was collected in open pasture land, and I found similar specimens in

other places of a like nature. It appears like an introduced species, and I suspected it was *V. arvensis*. So far as I know, it has not been previously recorded here, and there is no specimen in the herbarium of the botanical society. The other specimen also referred to *V arvensis* was collected in the Allegheny Mountains near Altoona, and differed from the first in the size, shape and abundance of the leaves. It was growing on a hillside in the woods, far from any house or road and at some distance from cultivated ground, so that it appeared to be indigenous.

LETTERS TO THE EDITOR.

***Correspondents are requested to be as brief as possible. The writer's name is in all cases required as a proof of good faith.

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

Feigned Death in Snakes.

It was I who suggested to Professor Kilpatrick the possibility of the apparent biting of itself by *Heterodon* being in mimicry of that which was claimed for the rattlesnake. But I do not at all *know* that the rattlesnake *has* any such habit. I have often heard it from the herdsmen on our prairies in an early day concerning our short Massassaugas, *Caudisona tergemina* (Cope). I have repeatedly heard persons say that they had taken a small switch and teased a rattlesnake till, in its anger, it would bite itself and die. But after reading Dr. Mitchell's statement that he had often injected the snake's own poison into its circulation without any apparent effect, I grew skeptical on the suicide theory. Professor Kilpatrick's narration to me recalled the traditions, and, knowing that this spread-head often mimicked the ways of poisonous kinds, it occurred to me this might be another manifestation. Cannot someone inform us whether it be true that any of the Crotalidæ have, or pretend to have, this suicidal habit, and can we not have some further statements from herpologists as to whether in any serpent its poison is fatal to itself or its fellows? Analogy would indicate that it might be. Bee stings are fatal to each other, and it seems well established that scorpions commit suicide by their own stings under certain circumstances of torment.

Apropos of the conduct of Professor Kilpatrick's snakes being a "*faint*, instead of a *feint*," it is perhaps well known that Dr. C. C. Abbott, in "Rambles About Home," claims that the similar conduct of the opossum is really a spasm from fear (rendering the creature unconscious), instead of a shamming of death.

J. N. Baskett.

Mexico, Mo.

A Peculiar Flora in Chicago.

While in Chicago last July I spent some little time in botanizing in the vicinity of the Fair grounds, and I was much struck with the peculiar flora of two vacant lots in that neighborhood. One of these is at the corner of Oglesby avenue and Sixty-second street, and is very dry with the grass cropped short by grazing animals. Here I was surprised to find the ground covered with *Potentilla anserina*, which I have never found previously in any but very marshy places. Indeed, until I had analyzed it, I could scarcely believe that it was not some other species. The plants were all very dwarfed, presumably from their unfavorable environment, but otherwise agreed perfectly with *P. anserina* from other localities. On the edge of this same lot was a thriving specimen of *Habenaria leucophaea*, also a plant of the marshes, and so out of place here. I am inclined to think, therefore, that before the extension of the city so far south these lots were marshes and the plants are but survivors of the former flora.

In the other lot, however, at the corner of Woodlawn avenue and Fifty-ninth street, the peculiar flora does not admit of as easy an explanation. In this field the soil was rich and moist (though nowhere wet) and covered with a good growth of grass and sedges. Here I found several specimens of *Galium boreale*; and *Calamintha nuttallii* was abundant. The former, according to Gray, is an inhabitant of the "rocky banks of streams," while the latter occurs only on "wet limestone river banks." So unlikely a place did it seem for *Calamintha* that I sent a specimen to the Gray Herbarium at Cambridge, but Mr. Fernald, who very kindly examined the plant, assures me that my identification was correct. He suggests also that the species may have been introduced in that place, but I must say that this seems improbable to me. Perhaps some one more familiar with the botany of Cook County may be able to explain the occurrence of these two species in such an unlooked-for locality.

Hubert Lyman Clark.

Pittsburgh, Pa.

Eskimo Traces in New York.

Sir Daniel Wilson once suggested a connection between the Eskimo and the Iroquois, founded on physical structure. The habits of the two were so different, however, that this is probable only in a slight degree. That the Eskimo once roamed where the Iroquois afterwards lived seems certain. If the Northmen reached the shores of New England, the Eskimo must even then have dwelt along the coast, and archæology makes it probable that a large part of the Middle States had not then been occupied by the so-called Indian tribes.

The recent collections made far north have been especially interesting to me as bearing upon some relics found in New York and Canada, and in a less degree in New England. The one-sided harpoon of Alaska differs in no respect from those which the Mohawks and Onondagas used three hundred years ago. The half-circular slate knives found all through the territory mentioned are like those of the Eskimo women now. The Ninth Report of the Bureau of Ethnology contains other suggestive material. Through central New York, in portions of the Province of Ontario, in Canada, and along Lake Champlain occur double-edged polished slate knives, arrow-like in form, almost identical with those on page 151 of the report and some following pages. Rarely have I seen them single-edged, and, as they usually occur near streams, I have thought they were used in opening and cleaning fish. Almost all those I have seen in New York and Canada have slight barbs, a feature which seems lacking in the Eskimo knife. With us they are made of various kinds of slate, and I have one very broad form of red slate. Usually they are dark grey. The flat tong is always bevelled, and often notched. A very delicate and beautiful one I recently figured from the Oneida River.

If the Iroquois used combs at all before European contact, they were very simple, but some of their later examples remind one of those of the Eskimo under similar circumstances. The wooden and horn spoons are also suggestive, the broad wooden spoon occurring

among the Onondagas yet. In both cases these may be due to a new environment. The flat soapstone vessels, with their many perforations, are earlier in New York than the Iroquois occupancy, and altogether apart from it. Many of them have handles, and they occur along the larger streams. The material is not found in the State, as far as I remember, and they seem to have been brought here by fishing parties. The common forms are like some Eskimo vessels.

The figure on page 136, representing a man's belt, is of special interest, as showing the reputed form and material of the primitive Iroquois council belt, afterwards made of wampum. The foundation of this Eskimo belt is like that of a wampum belt, but quills, or shafts of feathers, form the pattern instead of beads. Now, it is a clearly proved fact that the Iroquois and their predecessors in New York had no shell beads suitable for belts, and very few at all. Loskiel said that they used small colored sticks. In a paper on "Hiawatha," and in my "Iroquois Trail," I have given some Iroquois stories on their first use of wampum, in some of which the wampum bird figures. One of these represents Hiawatha stringing the quills of the legendary black eagle. The Mohawk chief, however, cannot call down the sacred bird, and sends a string of partridge quills in return. An Onondaga told me that their early belts were made of the quills of birds or of porcupines, which were afterwards replaced with beads. The latter have been found on no early sites, and are quite modern with them.

W. M. BEAUCHAMP.

Baldwinsville, N. Y., Dec. 4, 1893.

A MINIATURE WATER LILY.

DURING an extended tour the past summer in northern Minnesota I came upon a beautiful little white water lily. It is an almost exact miniature of *Nymphea odorata*. The flowers are about an inch and a half across. The leaves are oval-sagittate, three-fourths inches long. I found it only on the south branch of the Tamarack river, which flows into the northeast corner of Red Lake. It is there quite abundant. Can any of your readers give more information concerning it?

J. E. TODD.

University of South Dakota, Dec. 1.

FEIGNED DEATH IN SNAKES.

IN *Science* for Nov. 3 is an article on "Feigned Death in Snakes." Probably the writer is correct in his statement that the Heterodon does not (usually) bite himself just before feigning death. I recall one instance, however, in which a large black blowing viper, in the act of feigning death, contrived somehow to get his teeth (such as they were) caught in the skin on his side, and he was lying thus when I picked him up and loosed the teeth. This may have been accidental. I have often tried to get these snakes to bite something—anything—my hand, for instance, and never succeeded. But I have occasionally had one of them strike me a sharp rap with the end of his nose—of course without doing any damage. Moreover, I have not observed that they *usually* eject the contents of the stomach. When one of them has recently swallowed something, especially if it is something bulky, he will often (perhaps always) eject it before trying to escape or feigning death. But otherwise, my observation has not led me to believe that it is a common practice.

However, the thing that I especially desired to hear about was the action of rattlesnakes under similar circumstances. I have never seen a rattlesnake feign death, but reliable parties have reported the fact; only they generally speak of it as the snake killing himself. For they all state that the rattlesnake does bite himself and then seems to die. (The quickness with which they appear to die is suspicious). Now Dr. Mitchell states, after much study and experiment with the poison of snakes, that the poison of a rattlesnake injected under the skin of the same animal does not cause death. It is about these animals and their apparently pretended suicide that I would much like to hear.

J. W. KILPATRICK.

Fayette, Mo., Dec. 1.

DR. TOPINARD AND THE SERPENT MOUND.

IN the November 10th issue of *Science* Dr. Brinton has very properly replied to Dr. Paul Topinard, the eminent French anthropologist. American students, who have been so frequently told how much more the French know concerning prehistoric archæology than the scientists of this country, will find a great deal of satisfaction in noting the ignorance which the great savant Dr. Topinard displays in his article. I wish to call the attention of the readers of *Science* to the fact that, while Squier and Davis published an excellent map of the Serpent Mound (in Adams County, Ohio), Caleb Atwater wrote concerning it in 1820. So the eminent Frenchman has made a mistake of about sixty years in attributing the discovery to Professor Putnam. One can easily understand and overlook a mistake in locating or describing the small earthworks or western ruins on the part of the distinguished foreigner, but, after all that has been published about our greatest monument, the Serpent Mound, it is very strange that one whose entire life has been given to the study of prehistoric peoples should have fallen into such an error regarding it.

WARREN K. MOOREHEAD.

THE HARDNESS OF CARBORUNDUM.

REFERRING to my article on "Carborundum" (*Science*, XXII., 141), it is there stated that the discoverer of this substance claimed that it would cut and polish the diamond. In the December number of the *Am. Jour. Sci.*, XLVI., 473, Mr. G. F. Kunz states the result of an experiment made by him to determine this. A new wheel was provided, and, after several trials, it was found that the carborundum, though hard enough to cut sapphire and corundum, would not cut or polish the diamond. The carborundum crystals may be scratched by diamond points. The hardness is thus between 9 and 10, and it is, next to the diamond, the hardest substance known.

WM. P. BLAKE.

LATE-BLOOMING TREES.

WHILE at Brielle, N. J., I noticed, during the first week in September, several apple trees blooming quite freshly, and I have reports from Alpine, N. J., of pear trees and horse chestnuts being in bloom. Can any of your readers give an explanation of the cause and the effects (upon the trees) of this occurrence?

WALTER MENDELSON.

New York City.

TELLURIDE OF GOLD, CRIPPLE CREEK, COLORADO.

THE native gold of Cripple Creek, whether obtained from the placers or from the veins, is remarkably fine, being worth twenty dollars, or more, per ounce. It contains very little silver, and appears to be derived from a telluride allied to, if not identical with, the species calaverite, which contains about 41 per cent. of gold. The telluride is silver white, and is in prismatic crystals, much striated. In the oxidized ores the tellurium has leached out and left the gold behind in a spongy condition, but retaining the form of the original crystal. A purple-

colored fluorite in small cubic crystals is a common associate of the telluride. The rocks of the district are mostly granitic. The ores of high grade are successfully worked by smelting, rather than by milling.

WM. P BLAKE.

New Haven, Conn.

BOOK-REVIEWS.

A Pocket Key to the Birds of the Northern United States. By A. C. APGAR. Trenton, N. J., John L. Murphy. 50 p., 50 cents.

THIS small book, which can readily be carried in one's pocket, gives a simple, usable key which will enable a student of nature to determine the family and usually the genera of any of our northern birds. It will be especia ly valuable as a field book for one to carry in short excursions.

The Soil in Relation to Health. By H. A. MIERS, F. G. S., F. C. S., and R. CROSKEY, D. P. H. New York, Macmillan & Co. 130 p., $1.10.

As the result of the recent advance in matters of hygiene many short accounts of the hygienic characteristics of water and milk have been presented to the public. The suggestion of soil in relation to health is a somewhat new one. At the same time, it is perhaps as old as any in general estimation, for every one has some conception that certain kinds of soils are not healthful. In this little volume of 130 pages are collected all of the general facts known in relation to the hygiene of the soil. It is discussed especially in connection with the subjects of the water in the soil, the air in the soil and micro-organisms in the soil. The relation of the soil in the distribution of most important diseases is discussed, and the relation of ground water to all phenomena of health is considered carefully. In short, this little volume presents the factors which should be considered in determining the healthfulness of any locality, so far as concerns its soil.

The Inadequacy of "Natural Selection." By HERBERT SPENCER. New York, D. Appleton & Co.

IN this little pamphlet have been republished the three essays on the subject of Weismannism published by Herbert Spencer in the *Contemporary Review* in 1893. These trenchant criticisms of Weismann's theory are well known and need no comment. In this form the essays form a valuable addition to any library on the subject of recent views of heredity.

The Native Calendar of Mexico and Central America: A Study in Linguistics and Symbolism. By DANIEL G. BRINTON, M D., LL.D. Philadelphia, David McKay.

THERE is probably no question more important in American archæology, and none more obscure, than that of the calendar in use by the natives of Mexico and Central America before the Spanish conquest. Up to the present time its solution has foiled every student, from Humboldt down.

In the essay before us the author does not take up the mathematical and astronomical problems involved, but aims to define the geographical extension of the calendar, its probable origin and its symbolic meaning. His results may be briefly stated. The same calendar system is shown to have prevailed among all the semi-civilized nations of Mexico and Central America; its origin, he inclines to think, was among that branch of the Mayan tribes which dwelt near the great ruins of Palenque and Ocozingo, and built those cities; and it arose at first not as a time-measure, but as a means of astrological divination, and only later was brought into relation to the luni-solar year-counts of the tribes who adopted it. Its essentially symbolic character is explained at considerable length; and the etymology of the day and month names in the different languages is presented with greater fullness than has hitherto been attempted.

A Theory of Development and Heredity. By HENRY B. ORR, Ph. D. NewYork, Macmillan & Co. 255 p.

ANY new presentation of the subject of heredity is welcome, for in recent years biological discussion has become so intimately associated with this subject that there is a general impression among students that no further advance along the lines of biological truth is possible until this problem of heredity is in a measure solved. Prof. Orr, of Tulane University, has endeavored to give us a new view upon the subject of development and heredity. His theory, while not absolutely new, perhaps, is certainly fresh and novel in its applications, and in its association of facts somewhat widely distinct and hitherto kept separate.

The theory of Prof. Orr has in it some of the features of Weismann, inasmuch as it is based upon the supposed continuity of germ plasm, but differs radically from Weismann's theory in assuming the possible and, indeed, the necessary modification of this germ plasm, by the conditions surrounding the adult. The theory is in reality an expansion of the old statement of Haeckel that heredity is memory. The phenomena of heredity and development are based by Prof. Orr wholly upon the nervous system of organisms, and this nervous system he traces through the lower organisms, and even extends it through the vegetable kingdom, thus finding the essential features of the nervous system co-existent with life. Heredity is habit; the germ substance is continuous from generation to generation, and its nervous factors remember. Great stress is placed upon the known facts of the acquirement through habit of reflex actions by the nervous system of the higher vertebrates, and a similar action is supposed to be possessed in all protoplasm. The theory assumes that protoplasm, like other matter, is extremely plastic and undergoes physical or molecular modifications with every action of the environment upon it. Acquired characters of the adult affect all the protoplasm of the body, including the germ plasm, and form thus the most important basis of modification and development. The theory, in short, is an attempt to show that heredity is due to slow modifications of the nervous system of the germ plasm, produced upon it by changed conditions, and applies equally to the body protoplasm or the germ plasm.

The view of Prof. Orr is suggestive, but it is doubtful if it explains very much. If Weismann's theory became popular and spread all over the world rapidly because of its simplicity and ready comprehension, it is safe to say that Prof. Orr's theory will not have a like history. The theory itself is a little more difficult to understand than it is to understand heredity without it, for to explain everything by a nervous system whose very presence is, in lower organisms, a matter of hypothesis, does not advance us very much on the line of simplicity. If Prof. Orr's theory is true, it is certain that biologists are not ready for it, because it relegates the whole subject of heredity and development to that one branch of biology of which we professedly know least, namely, that of mind. In spite of this, the discussion of Prof. Orr is full of suggestion, and will undoubtedly repay thorough reading and careful thought on the part of any student of nature.

Method and Results. By THOMAS H. HUXLEY. New York, D. Appleton & Co. 8vo., $1.25.

THIS book is the first of a series of nine bearing the general title of "Collected Essays," in which Prof. Huxley intends to gather together his scattered essays and addresses in a permanent form. One of the essays in this volume relates to Descartes' "Discourse on Method," and is designed to set forth Prof. Huxley's own views as to the right method of scientific investigation; while the other

essays, according to the preface, show the results of this method as applied to various questions. Hence he has entitled the book "Method and Results," but the various essays are so heterogeneous in character that the reader is likely to think that almost any other title would have served about as well. The book opens with a brief autobiography, which will interest the author's admirers for the account it gives of his early life and education; but it has little to say of his later scientific activity or of the many controversies in which he has been engaged. The longest paper of those here collected is that on "The Progress of Science," which was published at the time of Queen Victoria's jubilee, and with which the readers of this journal are doubtless familiar. Of the remaining essays several, of which the earliest is dated 1866, relate to physical science and the importance of cultivating it; while no less than four, mostly of recent date, are concerned with political topics. The main object of the latter is to set forth Mr. Huxley's views on the much debated question of socialism against individualism, as to which he occupies a middle ground in opposition to the extreme doctrines of both parties. He fails, however, to lay down any principle for the practical guidance of statesmen which will enable them to steer wisely and safely between the two; while much that he says about Rousseau and the social contract, though for the most part true enough, is merely a threshing of old straw. The whole book is marked by the vigor and earnestness that characterize all of Mr. Huxley's writings, as well as by that positiveness that he usually shows even when expressing the most "agnostic" opinions. The whole series of volumes, of which this is the first, will consist, we suppose, of works that have been published in some form before; but they will be handsomely printed, and readers will like to have the essays in a collected form.

Catalogue of Section One of the Museum of the Geological Survey, Embracing the Systematic Collection of Minerals and the Collections of Economic Minerals and Rocks and Specimens Illustrative of Structural Geology. By G. CHRISTIAN HOFFMAN, F. Inst. Chem., F. R. S. C. Printed by F. E. Dawson. Ten cents.

THE recently issued catalogue of section one of the museum of the Geological Survey of Canada embraces the systematic collection of minerals, and those of economic minerals and rocks, as well as a smaller series illustrative of structural phenomena. From it we learn that the collections comprise between 6,000 and 7,000 specimens. The systematic series is arranged in accordance with the classification employed in the latest edition of Dana's Mineralogy. The economic series is arranged as in the following synopsis: I. Metals and Their Ores. II. Minerals Applicable to Certain Chemical Manufactures. III. Minerals Used in the Production of Light and Heat. IV. Minerals (and Material Manufactured from Certain of the Same) Applicable to Common and Decorative Construction. V. Minerals Employed as Pigments. VI. Refractory (Fire Resisting) Minerals. VII. Brines, Salt and Mineral Waters. VIII. Minerals Applicable to the Fine Arts and to Jewelry. IX. Minerals Employed, with or without Previous Preparation, as Fertilizers. X. Minerals Employed for Grinding and Polishing. XI. Minerals of Miscellaneous Application.

The arrangement as above outlined is not wholly free from defects, but the present writer will venture the assertion that no one who has himself wrestled with the problem of museum installation will be inclined to criticize it too harshly. It will be always an open question as to whether, in such cases, material had best be arranged by kinds, and their use indicated by labels and handbooks, or whether we should attempt to classify according to usage, as above. The first method is much the easier, and to the systematic student the more useful since it involves much less duplication of material. Unfortunately the visiting public usually prefer seeing specimens to reading labels; at least the specimen must be seen first. Hence some such arrangement as that adopted by the Canadian Survey seems most nearly to meet their wants, though it must be acknowledged that it is wasteful of both space and materials, and vastly more troublesome in carrying out. The mineral quartz well illustrates this point. In its various forms it is used for optical purposes; in jewelry; as an abrading material; in the manufacture of glass, china or earthenware; as an adulterant in paints, and (in the form of sand) in mortar and brick making. This involves a duplication and reduplication of materials and labels which is at least trying. Concerning the effectiveness of the exhibit, naturally nothing can be learned merely from a perusal of a catalogue without illustrations other than a diagram of the exhibition hall. The least that can be said, is that it shows a very pains-taking and commendable attempt at making the work of the survey available to the public.

Examen Sommaire des Boissons Falsifiées. PAR ALEX. HÉBART, Préparateur aux travaux pratiques de Chimie à l'Ecole de Médecine. Paris, Gauthier-Villars et Fils. 171 p. 1893. (Broché 2 fr 50c. Cartonné 3 fr.)

IN this work is comprised a study of the more frequent of the adulterations with which many modern manufacturers load our wines and other table liquors. M. Hébart has aimed to produce a work for the educated public and for the amateur, which will be at once readable and intelligible to all of even elementary acquaintance with the science of chemistry. Unlike some other books of like intention, this manner of treatment has not drawn from the scientific usefulness of the work, and while many theoretically and practically difficult methods of analysis are omitted those which are described are admirable for their accuracy and applicability. A large number of important facts are advanced in the five chapters devoted successively to wines, ciders, beers, brandy and liquors, and vinegar, and at the same time many popular fancies regarding the adulterations of these liquids are exposed. In general terms the treatment in each of the above named chapters is as follows: First, a discussion of the history and composition of the crude material and finished products; second, a summary of the different varieties produced, and, third, a study of the adulterations and their characteristics, with particular attention given to those forms of adulteration which are most commonly met with. A popular exposition of scientific facts treated successfully in a scientific manner is sufficiently rare to make this work of M. Hébart's unique and of considerable value.

A Laboratory Guide for a Twenty Weeks' Course in General Chemistry. By GEORG WILLARD BENT N, A. M., Instructor in Chemistry, High School, and Chemist for the City of Indianapolis, Ind. Boston, D. C. Heath & Co. 163 p. 1893.

THIS little book is designed as an aid to the student in elementary chemistry and is addressed to him alone, with words of advice as to chemical manipulation and laboratory methods. The experiments (over 150 in number) are systematically arranged and are so placed before the pupil as to aid him in drawing his own conclusions by logical deductions from the facts observed. Methods of measurement, the comparison of physical and chemical change, the properties of the non-metals, their compounds, and the metals are illustrated in succession and with simplicity. In several cases the experiments have, however, been rather injudiciously chosen, as, for in-

stance, experiment 7, coming under the head of "Various Ways of Inducing Chemical Change." The student is told to mix together potassium chlorate, sugar, and concentrated sulphuric acid, these directions being followed by an interrogation mark, which is presumably intended to elicit from the student an explanation of what has taken place. An exclamation point would, however, seem more suitable after such an experiment!

NOTES AND NEWS.

On Dec. 5 Professor William H. Holmes read a paper before the Anthropological Society of Washington, in which he connected some types of pottery from the extreme southern states with that of the Caribs, by means of the peculiar style of ornamentation, observed also on the wood-carving described in Prof. O. T. Mason's pamphlets on the Latimer collection and the Guesde collection. In this same connection it is interesting to recall the observations of Prof. Jeffreys Wyman upon the evidence of cannibalism in the shell-heaps of the St. John's River, east Florida. Professor Wyman first came upon these evidences in 1861 and the results are stated in the seventh annual report of the Peabody Museum, published in 1874. With this bit of evidence, connecting the Caribs with southeastern United States, should also be associated the practice of some southern tribes of weaving a band of cotton or other textile above the calf of the leg so as to increase the size of the limb. This was practised by the Caribs also. Not much weight should be given to the co-existence among the Caribs and the southern tribes of the sarbacan and the blow-tube, because the last-named apparatus might be found wherever good straight reeds occur. The Cherokees, the Choctaws, the Chetimachas, the Attacapas, and perhaps some other tribes, make use of this weapon. It is interesting to mark that the Chetimachas anticipated the invention of the revolving fire-arm by employing the compound blow-tube made by fastening four or more canes together, as the tubes in an organ or pan-pipe. Perhaps no one of these fragments would absolutely identify the Caribs with the southeastern Indians, but it would seem strange if a people who could navigate the Caribbean Sea in large open boats were incapable of crossing from Cuba to Florida.

—*Nature* announces the death of Baron von Bülow, at Kiel. Von Bülow's Observatory, better known, perhaps, as Bothkamp Observatory, was the first in Germany devoted to astro-physical researches, and it stands as a splendid monument to his interest in astronomy. By his death astronomical physics has lost one of its most enthusiastic supporters.

—Macmillan & Co. will publish very shortly a work on "Mental Development in the Child and the Race," by Prof. J. Mark Baldwin, of Princeton, editor of the *Psychological Review* and author of the "Hand-Book of Psychology," etc. This book is to be a contribution to genetic and comparative psychology. It will deal in detail with the child's mental growth, and with questions concerning the nature and capacities of the animal mind. Special treatment is given to the problem of the origin of the mental faculties, such as Attention, Memory, Speech, Handwriting, Imitation, Volition. Although the book is to be mainly scientific in its method and results, the author hopes to interest teachers of a psychological turn by such chapters as Educational Bearings of Imitation, Social Suggestion, Habit and Accommodation, etc.

—*Wiedemann's Annalen der Physik und Chemie* for November, says *Nature*, contains an interesting paper by R Hennig, on the magnetic susceptibility of oxygen. The method employed, namely, the measurement of the displacement in a magnetic field of a short column of liquid in a slightly inclined capillary tube, due to the difference in the susceptibility of the two gases (oxygen and air) at the two ends of the liquid column, would hardly seem at first sight capable of giving very accurate values. The author, however, has obtained very fairly consistent results, and finds the value $0{\cdot}0963 \times 10^{-6}$ for the difference between the susceptibility of oxygen and air at a temperature of about 26° C., and at pressures varying from 75 cm. of mercury to 328 cm. In

order to measure the strength of the magnetic field a small coil was suspended by a bifilar-suspension close to the capillary tube, and from the deflection, when a known current was passed through this coil, the strength of the field was calculated. The results obtained by this method were also compared with those found by the rotation of polarized light in a piece of heavy glass, and by means of a small induction coil which could be rapidly moved out of the field.

—**Macmillan & Co. have nearly ready for publication, under the title "Pain, Pleasure and Æsthetics," an essay by Mr. H. R. Marshall concerning the psychology of pain and pleasure with special reference to æsthetics. Some parts of the argument have already been presented in the pages of *Mind*, and the author acknowledges special indebtedness to the late Prof. Croom Robertson for sympathy and encouragement.**

—Some interesting investigations on the vitality of the cholera organisms on tobacco have been made by Wernicke (*Hygien: Rundschau*, 1892, No. 21), according to *Nature*. Small pieces of linen soaked in cholera broth-cultures were rolled up in various kinds of tobacco, and the latter were made into cigars. At the end of twenty-four hours only a few bacilli were found on the linen, and none on the leaf. On sterile and dry tobacco leaves, the bacilli disappeared in one-half to three hours after inoculation. On moist, unsterilized leaves they disappeared in from one to three days, but on moist and sterile leaves in from two to four days. When introduced into a five per cent. tobacco infusion (10 grams of leaves to 200 grams of water), however, they retained their vitality up to thirty-three days; but in a more concentrated infusion (one gram of leaves to two grams of water) they succumbed in twenty-four hours. When enveloped in tobacco smoke, they were destroyed, in broth-cultures, as well as in sterilized and unsterilized saliva, in five minutes. Tassinari, in his paper, "Azione del fumo di tobacco sopra alcuni microrganismi patogeni" (*Annali deli Istituto d'Igiene*, Rome, Vol. I., 1891), describes a series of experiments in which he prepared broth-cultures of different pathogenic microbes, and conducted through them the smoke from various kinds of tobacco. Out of twenty-three separate investigations, in only three were the cholera organisms alive after thirty minutes' exposure to tobacco fumes. But in actual experience the apparent antiseptic properties of tobacco have not unfrequently been met with; thus, during the influenza epidemic in 1889, Visalli (*Gazetta degli Ospedali*, 1889) mentions the remarkable immunity from this disease which characterized the operatives in tobacco manufactories; that in Genoa, for example, out of 1,200 workpeople thus engaged, not one was attacked; whilst in Rome the number was so insignificant that the works were never stopped, and no precautions were considered necessary.

—**Prof. Felix Klein, of the University of Göttingen, after attending the Chicago Congress of Mathematics last August, delivered a two weeks' course of lectures on modern mathematics at Evanston, Ill., before members of the Congress. These lectures will be published (in English) substantially as they were given, with the addition of the interesting historical sketch of the development of mathematics in Germany during the present century (up to the year 1870), recently contributed by Professor Klein to the work "Die deutschen Universitäten." The lectures present, within certain limits, a general view of the most important advances that have taken place in mathematical thought and research during the last twenty-five years. Only the rare ability, possessed in so eminent a degree by Professor Klein, for taking hold of the most characteristic features of a given subject and presenting it vividly to his hearers from various points of view, could make it possible to give so much in so small a compass.**

EXCHANGES.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

I am desirous of obtaining the following back numbers of *The Auk*: One copy each of Oct., 1885; July, 1886; January, 1887; July, 1887; April and July, 1891 and two copies each of the following: January, 1886 Oct. 1886; Oct., 1887; July, 1888; January, 1889; January, 1890. My own contributions in them only are required; otherwise the copies need not be perfect I have in exchange for them two vols. (zoology) Mex. Bound'y Surveys (col. plates) or complete set of English reprints of "Osteology of Arctic Water-Birds, etc." (6 parts, 24 lith. plates); or other rare scientific reprints of any subject required. Address Dr. Shufeldt, Takoma, D. C.

For Sale.—The first eleven volumes of Crooke's Quarterly Journal of Science, 7 vols. 1st series, 4 vols. 2nd series, beautifully bound, half morocco, as good as new, for $30. John J. Jarmey, 93 Indianola Place, Columbus, Ohio.

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WANTED.—A copy of Mascart & Joubert's Lessons in Electricity and Magnetism, Vol. I. Address R. W. Clawson, Vanderbilt University, Nashville, Tennessee.

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THE contents of the volume appeared serially in *Harper's Magazine* and *Harper's Weekly*, in which periodicals they attracted wide attention and favorable comment. Their importance fully justified their republication in a more permanent form. The book affords a more minute insight into the present condition of the West than can be found elsewhere. What it tells is the result of personal experience, fortified by information obtained from the best-informed and most reliable men in the localities under discussion, and set forth with admirable clearness and impartiality. It is a work to be read and pondered by those interested in the growth of the nation westward, and is of permanent standard value.—*Boston Gazette.*

STATESMEN.—$2.00.

IN the preparation of this work Noah Brooks has aimed to present a series of character sketches of the eminent persons selected for portraiture. The object is to place before the present generation of Americans salient points in the careers of public men whose attainments in statesmanship were the result of their own individual exertions and force of character rather than of fortunate circumstances. Therefore these brief studies are not biographies. Mr. Brooks had the good fortune of personal acquaintance with most of the statesmen of the latter part of the period illustrated by his pen, and he considers it an advantage to his readers that they may thus receive from him some of the impressions which these conspicuous personages made upon the mental vision of those who heard and saw them while they were living examples of nobility of aim and success of achievement in American statesmanship.

MEN OF BUSINESS.—$2.00.

W. O. STODDARD, who has just written a book published by the Scribners, on "Men of Business," tells how the late Senator Stanford chopped his way to the law. "He had grown tall and strong," says Mr. Stoddard, "and was a capital hand in a hay-field, behind a plough, or with an axe in the timber; but how could this help him into his chosen profession? Nevertheless it was a feat of wood-chopping which raised him to the bar. When he was eighteen years of age his father purchased a tract of woodland; wished to clear it, but had not the means to do so. At the same time he was anxious to give his son a lift. He told Leand, therefore, that he could have all he could make from the timber, if he would leave the land clelar of trees. Leland took the offer, for a new market had latterly been created for cord-wood. He had saved money enough to hire other choppers to help him, and he chopped for the law and his future career. Over 2,000 cords of wood were cut and sold to the Mohawk and Hudson River Railroad, and the net profit to the young contractor was $2,600. It had been earned by severe toil, in cold and heat, and it stood for something more than dollars.—*Brooklyn Times.*

ORTHOMETRY.—$2.00.

IN "Orthometry" Mr. R. F. Brewer has attempted a fuller treatment of the art of versification than is to be found in the popular treatises on that subject. While the preface shows a tendency to encourage verse-making, as unnecessary as it is undesirable, the work may be regarded as useful so far as it tends to cultivate an intelligent taste for good poetry. The rhyming dictionary at the end is a new feature, which will undoubtedly commend itself to those having a use for such aids. A specially interesting chapter is that on "Poetic Trifles," in which are included the various imitations of foreign verse in English. The discussion of the sonnet, too, though failing to bring out fully the spiritual nature of this difficult verse form, is more accurate than might be expected from the following sentence: "The form of the sonnet is of Italian origin, and came into use in the fifteenth [*sic*] century, towards the end of which its construction was perfected, and its utmost melodious sweetness attained in the verse of Petrarch and Dante." In the chapter on Alliteration there are several misleading statements, such as calling "Piers the Plowman" an "Old English" poem. In the bibliography one is surprised not to find Mr. F. B. Gummere's admirable "Handbook of Poetics," now in its third edition. In spite of these and other shortcomings, which can be readily corrected in a later issue, this work may be recommended as a satisfactory treatment of the mechanics of verse. A careful reading will improve the critical faculties.—*The Dial.*